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Swine Feed Efficiency: Influence of Ractopamine

Abstract

Ractopamine hydrochloride (RAC), a beta-adrenergic agonist, is the active ingredient in the feed additive Paylean® (Elanco Animal Health). Paylean has become a widely used feed additive in the swine industry for market swine due to such benefits as improved average daily gain, improved feed efficiency, increased carcass leanness and improved nitrogen and water utilization.

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Swine Feed Efficiency: Influence of Ractopamine

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Introduction

Ractopamine hydrochloride (RAC), a beta-adrenergic agonist, is the active ingredient in the feed additive Paylean® (Elanco Animal Health). Paylean has become a widely used feed additive in the swine industry for market swine due to such benefits as improved average daily gain, improved feed efficiency, increased carcass leanness and improved nitrogen and water utilization.

Paylean was initially approved by the United States FDA for use in swine in 1999; the approval was modified in 2006. The current Paylean label reads **“feed at levels of 4.5 to 9 grams/ton RAC”**. The label indications state **“For increased rate of weight gain, improved feed efficiency and increased carcass leanness in finishing swine, weighing not less than 150 lbs., fed a complete ration containing at least 16% crude protein for the last 45 to 90 lbs of gain prior to slaughter.”**

Research Highlights for Ractopamine

A summary of 5 experiments (Table 1) and a review of 23 experiments feeding Paylean (Table 2), showed ADG increased by about 12% across RAC concentrations. Feed efficiency improved by 10% at 4.5 g/ton and 13.3% when feeding 9 g/ton, while feed intake showed a slight 2% reduction at 4.5 and 9 g/ton RAC.

Table 2. Average Paylean Effects on growth Traits of Pigs

Paylean Level, g/ton	0	4.5	9
ADG, lb/d	1.87 ^a	2.09 ^b	2.07 ^b
ADFI, lb/day	6.26 ^a	6.24 ^{ab}	6.11 ^{ab}
Feed:Gain	3.33 ^a	3.03 ^b	2.94 ^b

^{ab} Values with different letters within a row are different from each other at P<0.05. Adapted from Apple et al., 2007

Table 1. Average Paylean Effects on growth Traits of Pigs

Weight, lb		ADG			F/G			F/G	
Start	Target End	Paylean level, g/ton			Paylean level, g/ton			Improvement	
		0	4.5	9	0	4.5	9	0 vs. 4.5	0 vs. 9
200	245	2.29	2.47	2.56	2.94	2.70	2.63	8%	11%
245	290	2.01	2.40	2.45	3.57	3.13	2.94	13%	18%
200	290	2.12	2.34	2.31	3.33	3.03	2.94	9%	12%

Summary of 5 identical trials:300 (B&G) per trt, 3 pen/trt, trt ended when heaviest pen averaged target end weight. Adapted from NADA 140-863, 2006

The carcass effects also are dose dependent. Tenth rib backfat is not affected at 4.5 g/ton, but is reduced at 9 g/ton Paylean. However, loin eye muscle area is increased in a dose dependent manner with each increase in Paylean dose. Carcass yield is slightly improved with each increasing dose of Paylean.

The effect of Paylean on pig growth is immediate; however, research has shown that the growth response is not constant over the duration of feeding. Lean accretion increases over 50% in the first week of feeding and declines to approximately 20% at the end of 4 weeks. The improvement in feed efficiency stems from more efficient utilization of feed rather than a reduction in feed intake.

Diet formulations need to be adjusted when Paylean is fed. Since pigs have the greatest response in growth rate and F/G when first fed Paylean (Table 4), dietary lysine levels need to also change with duration and dosage, as illustrated in Table 3. Research shows dietary lysine concentration needs to be increased by approximately 0.20 to 0.30 percentage units relative to diets without Paylean.

Table 3. Predicting Weekly SID Lysine Requirements for Gilts (0.75lb/d average lean gain) fed two levels of Paylean® (g/ton).

Paylean Level, g/ton	0	4.5	% increase	9	% increase
Week 1	0.72	0.95	31.9	1.01	40.3
Week 2	0.66	0.86	30.3	0.91	37.9
Week 3	0.62	0.75	21.0	0.79	27.4
Week 4	0.57	0.66	15.8	0.68	19.3

Modeling data from Schinckel et al., 2003 was applied to performance of gilts in Schinckel et al., 2009 from 215-270lbs of body weight.

Table 4. Impact of RAC dose and duration on group closeout F/G for Pigs 50 to 279-287 lbs.

RAC, g/ton	Week				Week				Week			
	Gain, lbs per week				Feed, lbs per week				F/G per week			
	1	2	3	4	1	2	3	4	1	2	3	4
0	13.1	13.1	13.1	13.1	41.1	42.4	43.7	44.9	3.14	3.24	3.33	3.43
4.5	15.9	15.0	14.2	13.3	42.7	44.9	45.0	42.9	2.68	2.99	3.18	3.23
9	17.1	15.8	14.6	13.3	43.1	44.8	45.2	44.2	2.52	2.83	3.10	3.33
	Week				Week							
	F/G Improvement				Cumulative F/G Improvement (50 lbs to period wt)							
	1	2	3	4	1	2	3	4				
0 vs. 4.5	14.5%	7.7%	4.8%	6.0%	1.1%	1.5%	1.7%	2.0%				
0 vs. 9	19.8%	12.7%	7.0%	3.0%	1.7%	2.4%	2.7%	2.7%				

Initial weight 227lbs with end wt of 279, 285 and 288lbs for RAC 0, 4.5, and 9 respectively. Table illustrates pigs starting at 50 lbs and assumes 431 lbs of feed to reach 227lbs. Adapted from Apple

Pratical Applications for Using Ractopamine

Feed efficiency is a resulting metric based on pounds of feed per pound of gain. Feed efficiency can be improved by: (1) reducing the amount of feed for the same amount of gain; (2) increasing the amount of gain for the same amount of feed or (3) a combination of both. This distinction is important when evaluating the potential return from feed additives or management changes because the feed represents expense and gain represents revenue. The final benefits of implementing Paylean into a feeding program may not be realized if the added cost of the diet exceeds the feed efficiency benefit alone. Packer matrices also need to be considered for potential revenue change.

Each operation is unique regarding pig flow (building turn on days or pig weight), uniformity of pig entry and market weights, percentage of saleable pigs, logistics of feed deliveries and pig marketing, feed cost, genetics, packer, and producers objectives. Field application of Paylean varies in dose (4.5 to 9 g/ton) and duration (2 to 7 weeks). Consider the following as you develop a feeding program that includes RAC.

- If non-saleable or cull pigs are transferred to different buildings for additional weight gain when a barn is being emptied, select and move pigs prior to the group being fed diets with Paylean. This is to avoid a long duration of feeding Paylean and diminished response to those individual pigs. Also, the growth benefits for pigs fed Paylean will be completely lost one week after its removal from the diet.
- Utilizing a step-up Paylean feeding program where the concentration of Paylean is increased during the second two weeks of a four week feeding program (for example) will help minimize the reduction in Paylean response over time.
- Phase feed or adjust dietary lysine as the duration of Paylean feeding increases.

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